

## Studies on the Symphylid Fauna of the Hawaiian Islands

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## INTRODUCTION

This paper is an attempt to summarize the knowledge of the Hawaiian Symphyla (Myriapoda). It is based on taxonomic studies of preserved symphylid material and all published information on the Symphyla of Hawaii.

During the last decade several zoologists have published observations on symphylids damaging growing crops. From Hawaii, too, there are many reports and notes on their injury, especially in the pineapple fields. While primary emphasis has been placed on the economic importance and control, taxonomic study has received secondary attention. Under these circumstances, it was a pleasure for me to accept an offer from Mr. K. Sakimura, Entomologist at the Pineapple Research Institute of Hawaii, Honolulu, to investigate the symphylid fauna of Hawaii from the basis of a collection brought together by him. As seen below, there are samples from all the large islands of the archipelago except Hawaii. All the samples were collected from pineapple fields, except one which was from a permanent pasture at 4,000 feet a.s. on the Island of Maui.

The Symphyla consists of two families: the Scutigereidae, with rather large and swift centipede-like representatives (Fig. 1a), and the Scolopendrellidae which are smaller slow-moving animals (Fig. 1b). The collection studied contained a total of 173 specimens, including representatives of both families.

The type specimens of the new taxa erected below have been deposited in the collection of the Bernice P. Bishop Museum of Honolulu, and some paratype specimens in the U.S. National collection, Washington, D. C.

## TAXONOMY

## Fam. SCOLOPENDRELLIDAE

Genus *Symphylellopsi* Ribaut, 1931*Symphylellopsi subnuda* (Hansen)

*Scolopendrella pygmaea* Silvestri 1902. In Berlese, ACARI, MYRIOPODA ET SCORPIONES HUQUSQUE IN ITALIA REPERTA. PADOVA.

*Scolopendrella subnuda* Hansen 1903. QUART. J. MICR. SCI. 47:70-72, pl. 6, figs. 2 a-g.

*Scolopendrellopsis subnuda* (Hansen), Bagnall 1913. J. LINN. SOC. (ZOO.), 32:199.

*Scolopendrella subnuda* Hansen, Bagnall 1914. TRANS. NAT. HIST. SOC. NORTH-UMB. DURH. NEWC.-UPON-TYNE, n. s. 4:31, pl. 1, figs. 10-13.

*Symphylellopsi subnuda* (Hansen), Ribaut 1931. BULL. SOC. HIST. NAT. TOULOUSE, 62:463-464, fig. 8.

Material.—MAUI; Olinda, under stones in a permanent pasture on the hillside of Haleakala, 4,000 feet a.s., 7. IV. 1959, No. S-128, coll. Sakimura, 2 ad.,<sup>1</sup> 2 juv. 11.—4 specimens.

Distribution.—This species has a wide geographical distribution in Europe and North Africa but has not previously been reported from the Pacific area.

### Genus *Symphylella* Silvestri, 1902

#### *Symphylella tenella*, new species (Figs. 1 b, 2 a-d)

Material.—LANAI; in pineapple fields at 1,700 feet a.s., 24. X. 1957, No. S-105, coll. Sakimura, 3 ad.—MOLOKAI; Naiwa-Uka, in pineapple field at 1,200 feet a.s., 29. II. 1956, No. S-58, coll. Sakimura, 3 ad.—OAHU; Helemano, in pineapple fields at 1,200 feet a.s., 18. III. 1959, No. S-123, coll. Sakimura, 9 ad., 3 juv. 11, 2 juv. 10, 2 stage ?—KAUAI; Kalaheo, in pineapple fields at 700 feet a.s., 20. I. 1959, No. S-119, coll. Sakimura, 4 ad.—26 specimens.

Holotype.—One of the adult specimens from Kalaheo, S-119.

Length.—2.70 mm. The length of adult specimens ranges from 2.37 to 2.75 mm., with an average of 2.67 mm.

Head.—1.2 times longer than broad, broadest a little behind the middle, lateral margins flatly rounded and articulating points of mandibles nearly concealed. Central rod well developed, with a transverse suture just behind the middle of the head; lateral branches lacking but frontal branches broad and strongly developed; the part of the rod between the forking point of the anterior branches and the interruption somewhat shorter than the part behind the interruption point. Dorsal surface of head rather sparsely covered with straight medium size setae. Diameter of postantennal organs 0.5 of the greatest diameter of third antennal segment (on most specimens this value is higher, 0.60–0.75).

Antennae.—Left antenna with 16, right with 18 segments, the terminal segments not fully developed. First segment about 0.75 as wide as the following segments, with 7 setae in a single primary whorl, the inner seta on dorsum longest, about 0.5 of the greatest diameter of the segment. Setae of proximal segments at least twice as long as those of apical segments. Second segment with a primary whorl of 10 setae, nearly all of the same length, rather evenly distributed around the segment. Third segment with 8 setae in a single primary whorl. Proximal segments with only one whorl of setae, a secondary whorl beginning on ventral side of 7th (on some other specimens 8th or 9th) segment. Distal segments also with smaller setae in the main whorls. Small circular sensory organs in the primary whorls present on the inner dorsal surface from 7th (on some other specimens 5th or 6th) segment outwards; a few bladder-shaped organs on some of the distal segments from 13th outwards.

<sup>1</sup> Abbreviations: ad., a specimen with the maximum number of legs; juv. . . ., a juvenile specimen with the number of pairs of legs indicated. These numbers include the rudimentary first pair of legs in *Symphylella*.

**Terga.**—First tergum rudimentary, having no triangular processes; with 8 setae in two groups of 4. Triangular processes on 13 of the 17 terga varying considerably in form and size. Second and third terga with the distance between processes (measuring along the posterior margins of terga) about 1.3 times as long as the length of the processes; this ratio more than 2.0 on 4th tergum. Triangular processes with tips posteriorly extended but not swollen; an apical seta at the tip, usually 2 setae between the apical and the inner basal setae. Antero-lateral setae of second tergum strikingly long, nearly as long as the triangular processes of this tergum; number of marginal setae between the antero-lateral and apical setae varying from tergum to tergum; including the antero-lateral and apical setae there are 7 to 8 on second tergum, 10 or 11 on third, and 6 or 7 on 4th; some slight variation in this respect is found on some other specimens. Posterior margins of anterior terga normally bearing 2 setae between the processes; some setae on the lateral margins of terga longer and more protruding than the others (Fig. 2).

**Legs.**—All pairs except the first well developed. First pair strongly reduced to two very minute knobs; each bearing one seta a little longer than the knob itself; a long seta just inside of the knob, about 5 times as long as the knob. Twelfth pair of legs covered with short delicate pubescence; tibiae with 4 setae on the outer side, the longest 0.6 to 0.7 of the width of the tibia; tarsi rather slender and cylindrical, about 4 times longer than wide, with 6 setae on distal and middle parts of the outer side, four of these outstanding and two depressed, the longest as long as or a little longer than the greatest width of the tarsus; anterior claw fairly robust but distally slender, nearly 1.5 times as long as the weaker and more curved posterior claw, at least as long as the width of the tarsus; frontal seta as long as the posterior claw.

**Cerci.**—3.5 to 4 times longer than wide, about as long as 12th pair of legs, clothed with a large number of setae, some of these on the ventral and outer surfaces straight and strongly protruding; such protruding setae in two ventral rows of 3 or 4 (on some older specimens up to 5 or 6) and in one outer lateral row of 3 (seldom 4); the longest of the protruding setae 0.4 of the width of the cercus; terminal area small, the apical seta a little longer than the length of the terminal area.

**Affinities.**—This species is closely allied to *S. capitata* and *S. sierrae*, both described from California by Michelbacher (1939a, 1939b). It seems also to be related to another American species, *S. neotropica*, which was collected by F. Meinert near Carácas, Venezuela and described by Hansen in 1903. However, *S. tenella* is easily distinguished from *S. capitata* by the cerci, the tips of the triangular processes, and the length of the antero-lateral setae of the second tergum in proportion to the length of the triangular processes. There are a large number of characters which separate it from *S. sierrae* (e.g. the relative length of the inner and outer setae of the proximal antennal segments, the tips of the triangular

processes, the length of the second setae posterior to the antero-lateral setae on the 4th, 7th, and 10th terga, and the number of protruding setae on the cerci). *S. tenella* is also distinguished from *S. neotropica* by some good characters (e.g. the first pair of legs and the claws of the 12th pair of legs). The last mentioned character also separates it from *S. simplex* which was described by Hansen in 1903 from the Island of Koh Chang in the Gulf of Siam.

Fam. Scutigerellidae  
Genus *Scutigerella* Ryder, 1882

*Scutigerella sakimurai*, new species (Figs. 3 a-i)

Material.—MAUI; Olinda, under stones in a permanent pasture on the hillside of Haleakala, 4,000 feet a.s., 7. IV. 1959, No. S-128, coll. Sakimura, 16 ad., 2 juv. 11.—MOLOKAI; Naiwa-Uka, in pineapple field, 1,200 feet a.s., 29. II. 1956, No. S-57, coll. Sakimura, 2 ad.—20 specimens.

Holotype.—One of the adult specimens from Olinda, S-128.

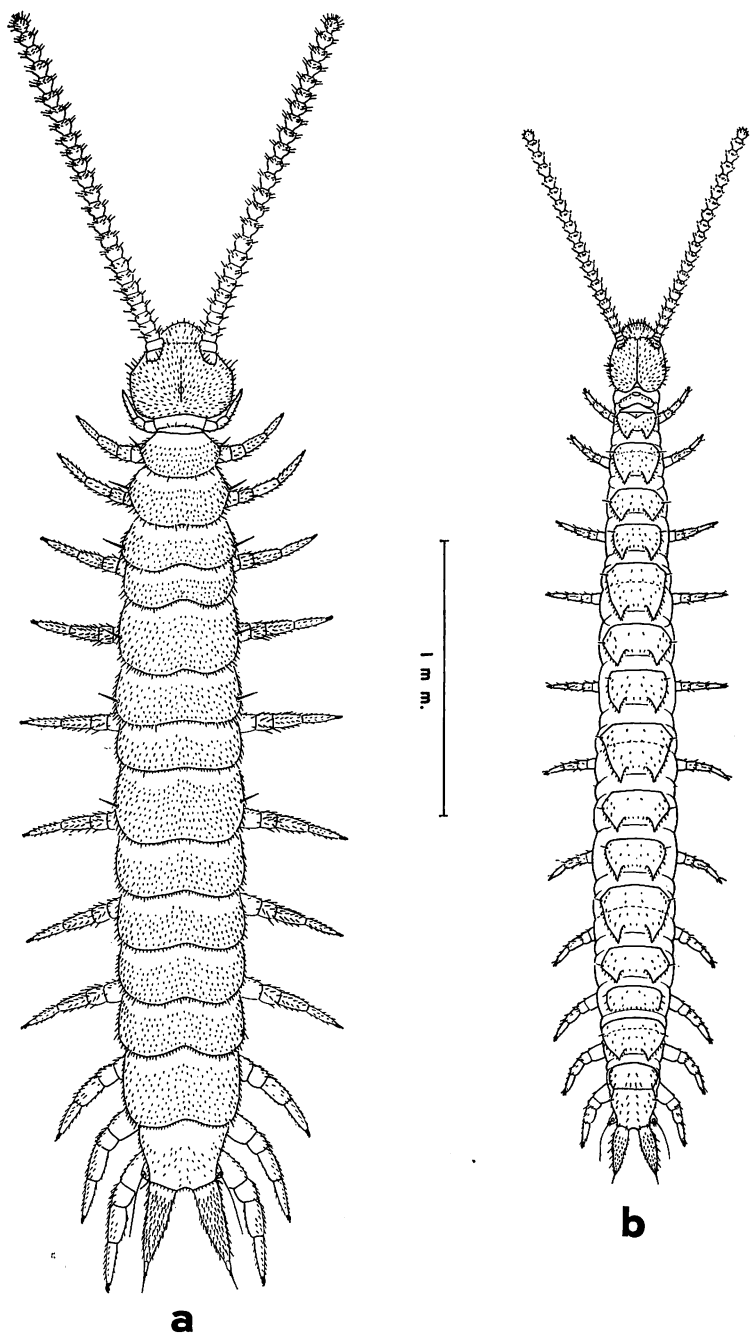
Length.—The holotype is considerably extended and measures 4.75 mm. The average length of the adult specimens from Maui is 3.85 mm.

Head.—1.2 times longer than broad, broadest in the posterior half, no lateral angle visible at articulating point of mandible. Central rod rather conspicuous but disappearing a little before the middle of head, connected posteriorly with a triangular area; distinct oblique rods lacking at the hind margin of head; frontal branches fairly well developed but considerably thinner than the rod itself. Seta in front of the posterior end of mandible a little longer than the greatest diameter of first antennal segment.

Antennae.—Left antenna with 27 and right with 29 segments (22 to 34 segments on the remaining specimens). First segment with 3 setae in a whorl, all on the dorsal and inner dorsal surfaces; an additional seta on the basal part of the inner side; the outer dorsal seta longest of the four, about 0.5 of the greatest diameter of the segment. Second segment also with a single primary whorl of 6 setae rather evenly distributed around the segment, setae of inner side a little shorter than the others. The proximal segments with only one whorl of setae on each segment; secondary whorls beginning on the ventral side of 5th to 6th segments; third whorls beginning on the ventral side of 8th to 11th segments (because of fusing of the primary and secondary whorls, it is very difficult to distinguish the three whorls). Terminal segment 1.5 times longer than broad; with a large number of mostly anteriorly-directed setae, nearly all of the same length; all prominent setae as long as those on the proximal segments; a large 4-spined seta arising from a circular protuberance at the apex of the segment,

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FIG. 1. The two families of Symphyla.—a, fam. Scutigerellidae, *Hanseniella unguiculata* (Hansen), somewhat contracted.—b, fam. Scolopendrellidae, *Symphylella tenella*, n. sp., fully distended. K. Sakimura, del.



nearly 0.3 as long as the segment. Setae on the first 4 segments more depressed than the rest.

**Terga.**—First tergum rudimentary; with 11 (10 to 12 on some other specimens) setae in two groups of 5 and 6 (5 + 5 or 6 + 6). Second tergum complete; posterior margin conspicuously emarginate with rounded lobes; 1.6 times broader than long; with 38 (30 to about 48 on some other specimens) setae of different lengths between the antero-lateral setae, the longest of them a little longer than 0.6 of the length of the antero-lateral seta; surface of tergum set with medium size setae. Third tergum a good deal longer than second tergum but only a little broader; about as broad as head; 1.3 times broader than long; hind margin more deeply emarginate than second tergum; small concavities on the lateral margins. Fourth tergum about 2 times broader than long. Fifth tergum like 4th, and 6th like 3rd but larger. Indented hind margins of all terga from the second forth with a peculiar structure as if they were creased. Posterior median cavity of 15th tergum broadly U-shaped, about as broad as long, the anterior part covered dorsally.

**Legs.**—Tarsi of first pair of legs 4.3 (on some other specimens 4.0 to 5.1) times longer than wide; both dorsal and ventral sides straight, but strongly tapering toward the distal ends; with 5 setae in the outer dorsal row. Tibiae of 12th pair of legs 2.1 times longer than wide; setae on both dorsal and ventral surfaces, the longest of these located on distal half of the dorsal surface and a little shorter than 0.5 of the greatest diameter of the tibia. Tarsi of 12th pair of legs slender and tapering toward their distal ends, each 4.3 (on some other specimens 3.7 to 4.7) times longer than wide; dorsal side nearly straight and ventral side curved; dorsal and ventral surfaces with 6 setae each in a row, nearly all of the same length, the longest of these 0.5 of the greatest diameter of tarsus. Anterior claw of 12th pair of legs a little shorter than 0.2 of the length of the tarsus. Styli of 12th pair of legs about 3.6 times longer than wide and about 1.2 of the greatest diameter of the tarsus; the apical seta 0.4 of the length of stylus. Coxal plates of 10th and penultimate pairs of legs with 4 setae; those of the last pair greatly reduced, with only one seta.

**Cerci.**—3.9 (3.4 to 4.4 on some other specimens) times longer than wide; dorsal side straight, ventral and inner sides convex; outer lateral margins strongly curved, with a concavity at the middle and a swelling nearer the distal end; densely set with short setae, the longest of these a little longer than 0.3 of the greatest width of a cercus; the apical seta 0.7 of the greatest width of a cercus.

**Affinities.**—*S. sakimurai* belongs to a group of species with deeply emarginate second terga. Among the species of this group, it seems to be most closely allied to *S. linsleyi* Michelbacher, *S. boneti* Hinschberger, and *S. mexicana* Hinschberger. The first mentioned species was described from Idyllwild in California, and has recently been discovered in the British Isles (Edwards 1959). The last 2 species were described from Mexico. The Hawaiian species differs from *S.*

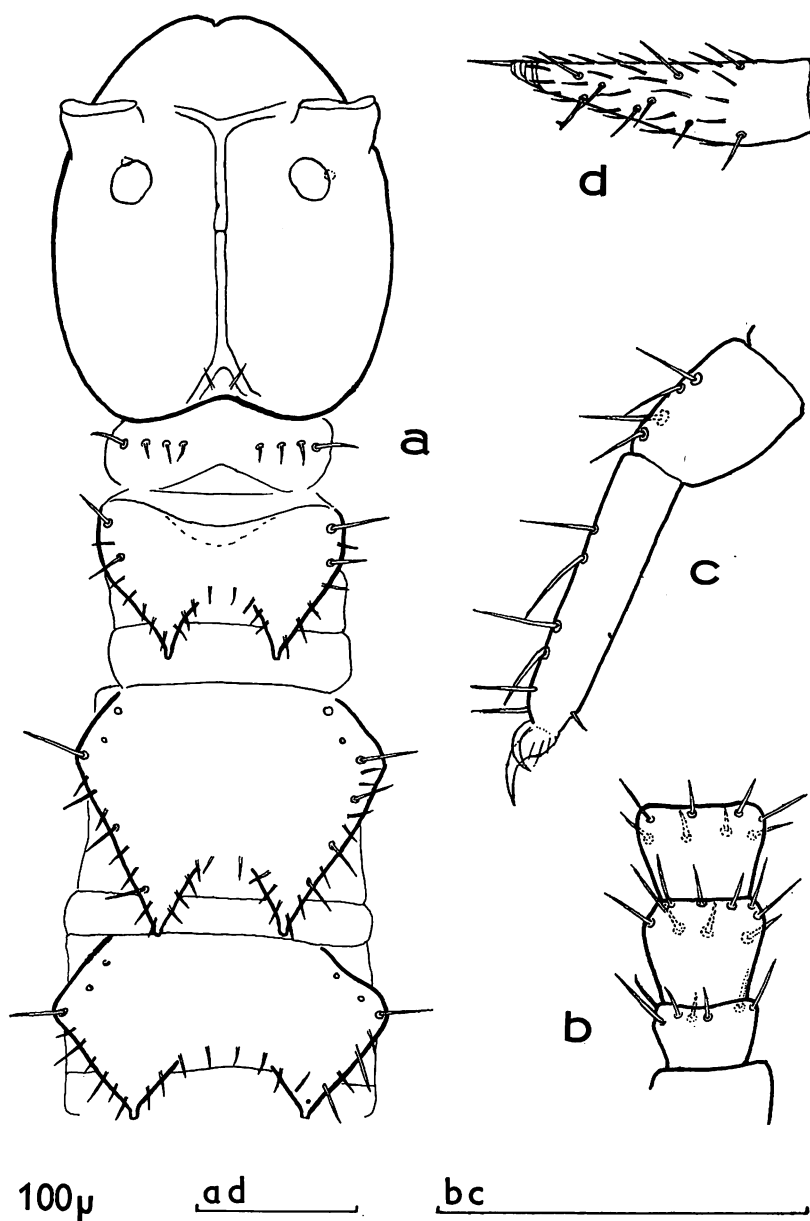


FIG. 2. *Symphylella tenella* n. sp.—a, head and first 4 terga (only marginal setae of terga drawn).—b, first 3 antennal segments of right antenna, from above.—c, 12th leg (pubescence not drawn).—d, right cercus, outer side.

*linsleyi* in the structure of the terga, legs, cerci, and coxal plates. It is also separable from *S. boneti* and *S. mexicana* especially by the terga, the 12th pair of legs, and the styli. *S. sakimurai* is also very close to *S. immaculata* sensu Michelbacher, but it can be distinguished from that species without any difficulty, especially by the proportionately shorter and broader caudal cavity with only a few setae on the dorsal covering.

### Genus *Hanseniella* Bagnall, 1913

#### *Hanseniella unguiculata* (Hansen) (Fig. 1 a)

*Scutigerella unguiculata* Hansen 1903. QUART. J. MICR. SCI. 47:34-36, pl. 2, figs. 2 a-k.

*Hanseniella unguiculata* (Hansen), Bagnall 1913. J. LINN. SOC. (ZOO.), 32:198.

Material.—MAUI; Honokahua, in pineapple fields, 500 feet a.s., 19. IX. 1958, No. S-114, coll. Sakimura, 5 ad., 2 stage ?—LANAI; in pineapple fields, 1,700 feet a.s., 24. X. 1957, No. S-105, coll. Sakimura, 44 ad., 1 juv. 11, 5 stage ?—MOLOKAI; Naiwa-Uka, in pineapple field, 1,200 feet a.s., 16. II. 1960, No. S-132, coll. Walter Carter, 8 ad.—OAHU; Makiki, Honolulu, HSPA Experiment Station ground, trash pile by a sugar cane planting, 50 feet a.s., 9. IX. 1955, No. S-51, coll. Sakimura, 3 ad., 1 juv. stage ?; Helemano, in pineapple fields, 1,200 feet a.s., 18. III. 1959, No. S-123, coll. Sakimura, 17 ad., 1 juv. 10, 10 stage ?; Kunia, in pineapple fields, 700 feet a.s., 30. III. 1959, No. S-125, coll. Sakimura, 9 ad., 1 stage ?—KAUAI; Kalaheo, in pineapple fields, 700 feet a.s., 20. I. 1959, No. S-119, coll. Sakimura, 13 ad., 3 stage ?—123 specimens.

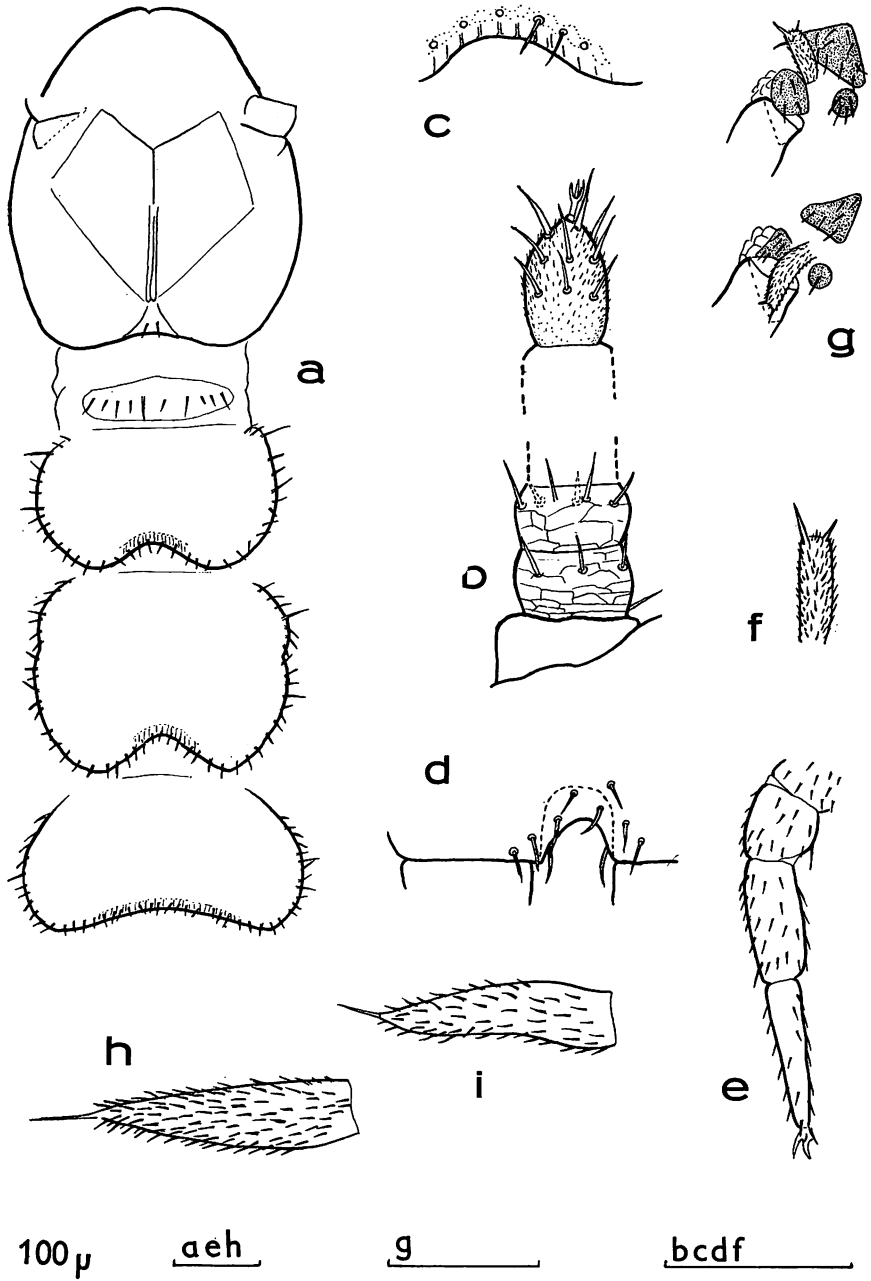
All *Hanseniella* specimens examined belong to *H. unguiculata*, but these vary considerably, and in some respects there are slight deviations from the original diagnosis. For instance, the posterior margin of the penultimate tergum is less emarginate, sometimes nearly straight in the Hawaiian material, while Hansen described it as conspicuously emarginate. The posterior claw of the first pair of legs is often proportionately larger than normal, though the shape is the one typical of *unguiculata*. Also, the anterior claw of the 12th pair of legs is usually fairly robust, approaching that of *H. caldaria* (Hansen).

Distribution.—This species is widely distributed as it has been collected on several continents. Only a few symphylids can compare with it in this respect. Hansen (1903) described it from several specimens from La Moka in Venezuela and it was later found in Asia, Europe, and Africa. Graveley (1910) mentioned it from Calcutta and Ceylon, and Scheller (1954) from the Philippines. From

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FIG. 3. *Scutigerella sakimurai* n. sp.—a, head and first 4 terga (only marginal setae of terga drawn).—b, left antenna, the first two and the apical segments, from above.—c, hind margin of 4th tergum showing its creased structure.—d, caudal cavity of 15th tergum, from above.—e, 12th leg.—f, stylus of the 12th pair of legs.—g, ventral view of the bases of the last two pairs of legs.—h, right cercus, outer side.—i, right cercus, from above.





Europe, Edwards (1959) has reported finding of *unguiculata* in hothouses in Britain. I have examined one specimen from Africa collected at Lastoursville, Gabon, by V. Aellen and P. Strinati in 1957.

#### RÉSUMÉ AND INTERPRETATION OF BIBLIOGRAPHICAL REFERENCES

There are several papers on the Hawaiian Symphyla. Most of them merely mentioned the group or particular species in faunal lists or in discussions of their destructiveness to growing crops. Especially, Van Zwaluwenburg and Illingworth called attention to the Symphyla as an economic problem in sugar cane and pineapple fields.

The first published observation seems to have been made at least 35 years ago. In 1925, the director of the Experiment Station of the Hawaiian Sugar Planters' Association (Agee, 1925) reported Van Zwaluwenburg's observation of *Scolopendrella* sp. in Hawaiian sugar cane field soil. The latter, who was conducting a soil fauna study on the grounds of the HSPA Experiment Station, Honolulu, did not, however, mention any symphylid species in his two preliminary reports (Van Zwaluwenburg 1926a and 1926b). Illingworth, who began to observe the Hawaiian pineapple insects in early 1926, mentioned a *Scolopendrella* sp. which was rather abundant in some pineapple field soils (Illingworth, 1926). For his further observations on symphylid injury on pineapple roots, the common names of symphylid or garden centipede were given, but no specific name was mentioned in his three notes (Illingworth 1927a, 1927b, and 1927c). In the first of these papers, he said that the symphylids are widespread in the pineapple fields and injurious to young plants. Illingworth, in his next paper (1928a), did not use the common name but called it a species of Scolopendrellidae.<sup>1</sup> This paper is a report of his root cage observations of egg-laying, hatching, feeding habits, and the injuries inflicted on the pineapple roots. The specific name of *Scutigerebella immaculata* (Newport) was given for the first time in Godfrey and Illingworth (1928) and Illingworth (1928b). Subsequently, Illingworth's determination of the common symphylid as *S. immaculata* was verified by H. E. Ewing, U.S. National Museum, and Illingworth (1929a) stated that: "This is the so-called garden centipede that gives trouble to truck crops in California, particularly asparagus in the Sacramento valley." This short note has since been referred by various subsequent workers (Baldwin 1935; Chapman 1931, Carter 1931, 1933, 1935a, 1935b, 1935c, 1936a, 1936b, Ito 1932; and Linford 1933) in reporting the injury, control, and natural enemies. It has been generally accepted also in zoogeographical discussions (Michelbacher 1938; Remy 1941, 1943, 1945; Scheller 1954; and Savos 1958). In 1928, Wymore (1931) also received some specimens for identification, and just as Ewing, he determined them as *S.*

<sup>1</sup> Up until Ribaut (1931) divided the family Scolopendrellidae, it included both Scolopendrellidae and Scutigerebellidae in the modern sense. It seems that the animal reported here by Illingworth probably belonged to the Scutigerebellidae, as his subsequent papers indicated.

*immaculata*. Illingworth (1929b, 1930) subsequently concluded his observations on the injuriousness of *S. immaculata* to pineapple in Hawaii. Williams in his HANDBOOK OF THE INSECTS AND OTHER INVERTEBRATES OF HAWAIIAN SUGAR CANE FIELDS (1931) stated that symphylids cause slight damage to sugar cane, and cited Illingworth (1928a) and Van Zwaluwenburg (1926a). Williams' paraphrasing of the latter on the symphylids is in error.

A short time after the presence of the family Scutigerellidae was verified (Illingworth 1929a), a second family was discovered as Van Zwaluwenburg, in his new Myriapod records (1931a), reported: ". . . among sugar cane soil fauna submitted to J. W. Folsom from the HSPA Experiment Station, there were numerous myriapods which he referred to Stephen R. Williams. The latter has made the following identifications: *Scolopendrella simplex*; *Scolopendrella neotropica*." A little later, Van Zwaluwenburg (1931b) published a full report of his project on soil fauna conducted during 1925 and 1926. In this paper he was no longer of the opinion that two different species occur on the Hawaiian Islands, as he recognized *Scolopendrella neotropica* or *S. simplex*. Van Zwaluwenburg found 90 to 150 Scolopendrellid specimens per square foot. *Scutigerella* sp. was less common at the site, but was thought also to attack sugar cane roots. The latter species was illustrated (Fig. 172) with an original drawing of a specimen collected at the HSPA Experiment Station.

It is apparent, partly from my taxonomic studies, and partly from the review of references on the Symphyla in Hawaii, that there must have been frequent confusion in species determination, as well as confusion in the nomenclature which was not yet well established in these early years. The occurrence of *Scutigerella immaculata* in Hawaii is possibly, but not probably, correct. When Illingworth and Ewing reported the Hawaiian *Scutigerella* as *immaculata*, only a single other species, *S. armata* (Hansen), was known in *Scutigerella* s. str. These two species are closely allied. The main distinguishing character is the peg-like projection which is found on the third joint of the first pair of legs on *armata*, but not on *immaculata*. This character is easy to observe, and it is not surprising that Illingworth and Ewing chose to refer the actual animal to *immaculata*, especially as this species seemed to be widely distributed. However, in the collection studied above I have not found the true *immaculata* but a new species of the genus fairly similar to *immaculata*, though not identical with it. Furthermore, I have also found that the common scutigerellid species collected in the pineapple and sugar cane fields is not a true *Scutigerella*, but *Hanseniella unguiculata*. It appears that Illingworth and Ewing have made a misidentification of species, and that nearly all the earlier records of *Scutigerella immaculata* really ought to apply to *Hanseniella unguiculata*. Since 1955, Sakimura has been involved in a symphylid project and made some clarification in this area. He recently found that the early determination of *S. immaculata*, as well as *Scolopendrella* sp. or a member of Scolopendrellidae, for the root-feeding species in the Hawaiian

pineapple fields was in error. Sakimura also discovered that the species collected at the HSPA Experiment Station in Honolulu, where Van Zwaluwenburg earlier conducted his observations, was *Hanseniella unguiculata*, and not *Scutigerella* sp.

Van Zwaluwenburg's records of the two Scolopendrellidae representatives, *Symphylella simplex* and *S. neotropica*, which were both described by Hansen under the genus *Scolopendrella*, are also probably misidentifications. The most common species of this family in Hawaii is *S. tenella* which has hitherto been found on the islands of Molokai, Lanai, Kauai, and Oahu. It seems most probable that the animal studied by Van Zwaluwenburg (1931a) belonged to this species.

#### NOTES ON ORIGIN OF HAWAIIAN SYMPHYLA

Sakimura's collection studied comprises material from the five islands. The greater part of the samples, 9 out of 10, comes from arable land, mostly from pineapple fields, and only one single sample from a non-cultivated area. *Hanseniella unguiculata* was nearly always present in every sample from the five islands. According to Sakimura, this species was very common in every cultivated area, and several times it was also collected in undisturbed forest areas at high elevation. Evidently this species possesses a capacity for living here not only in the pineapple and sugar cane fields but also higher up on the mountains. Another species abundant in the arable land is *Symphylella tenella* which was found in the pineapple fields of the four islands. It is obvious that these two are the predominant species in the cultivated areas. The former is a widespread species which has reached South America, Africa, Europe and the Philippines. As it is only slightly differentiated, it probably is an introduced newcomer which has succeeded in becoming well established in Hawaii. It is, however, at present difficult to determine whether *Symphylella tenella* is an exotic but naturalized species, or if it is indigenous to Hawaii.

Concerning *Symphylellopsis subnuda*, it must be mentioned that it is a widely spread species in the northern hemisphere and has a high capacity for adapting to different habitat conditions. For this reason, this species may be presumed to be a recent immigrant.

For *Scutigerella sakimurai*, the available information is still insufficient to express any certain opinion as to whether this species is endemic or has reached Hawaii recently, perhaps through the intervention of man. In this connection, it is interesting to note what Zimmerman stated when he discussed the origin and means of the dispersal of the Hawaiian fauna (1948, p. 163): "It is a fact that most of the native insects, both winged and apterous, are confined to single islands and most often to restricted ranges on those islands. Some of the newly introduced species, however, whether they may be beetles, flies, wasps or bugs, have spread rapidly, not only over entire islands, but have crossed the open-sea channels between the islands. . . . Man has had much to do with this inter-island dispersal." For clarifying the status of the two species described above,

*Symphylella tenella* and *Scutigerella sakimurai*, as well as for better knowledge of the symphylid fauna in general in Hawaii, we need more information, particularly from the undisturbed forest areas of the different islands.

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#### REFERENCES

- AGEE, H. P. 1925. EXP. STA. HAW. SUGAR PLANTERS' ASSOC., REPT. OF COMMITTEE IN CHARGE, for the year ending Sept. 30, 1925: 19.
- BAGNALL, R. S. 1913. J. LINN. SOC. (ZOO.) 22:195-199.
- 1914. TRANS. NAT. HIST. SOC. NORTHUMB. DURH. NEWC.-UPON-TYNE n.s. 4:31.
- BALDWIN, W. A. 1935. PINEAPPLE NEWS 9:74.
- CARTER, Walter 1931. PINEAPPLE NEWS 5:130.
- 1933. PINEAPPLE NEWS 7:76.
- 1935a. PINEAPPLE NEWS 9:76.
- 1935b. PINEAPPLE NEWS 9:117-118.
- 1935c. PINEAPPLE NEWS 9:234.
- 1936a. PINEAPPLE NEWS 10:24, 187.
- 1936b. PINEAPPLE NEWS 10:102, 270.
- CHAPMAN, R. N. 1931. PINEAPPLE NEWS 5:109.
- EDWARDS, C. A. 1959. PROC. ZOOL. SOC. LOND. 132:403-439.
- GODFREY, G. H. and ILLINGWORTH, J. F. 1928. PINEAPPLE NEWS 2:88-94.
- GRAVELEY, F. H. 1910a. SPOLIA ZEYLANICA 7:110-111.
- 1910b. REC. IND. MUS. 5:157-159.
- HANSEN, H. J. 1903. QUART. J. MICR. SCI. 47:1-101.
- HINSCHBERGER, PAULETTE. 1950. BULL. MUS. NATION. HIST. NAT. (Paris) (2) 22:256-262.
- ILLINGWORTH, J. F. 1926. BULL. EXP. STA. ASSOC. HAW. PINEAPPLE CANNERS 9:12.
- 1927a. PINEAPPLE NEWS 1:35-38.
- 1927b. PINEAPPLE NEWS 1:88-91.
- 1927c. PINEAPPLE NEWS 1:100-102.
- 1928a. PROC. HAW. ENT. SOC. 7:37-41.
- 1928b. PROC. HAW. ENT. SOC. 7:42-46.
- 1929a. PROC. HAW. ENT. SOC. 7:233.
- 1929b. PROC. HAW. ENT. SOC. 7:254-256.
- 1930. U.S.D.A. INSECT PEST SURVEY BULL. 10:25.
- ITO, K. 1932. PINEAPPLE NEWS 6:202-203.
- LINFORD, M. B. 1933. PINEAPPLE NEWS 7:19.
- MICHELbacher, A. E. 1938. HILGARDIA 11:55-148.
- 1939a. PAN-PAC. ENT. 15:21-28.
- 1939b. ANN. ENT. SOC. AMER. 32:747-757.
- 1941. ANN. ENT. SOC. AMER. 34:139-150.
- 1942. ANN. ENT. SOC. AMER. 35:267-288.
- REMY, P. A. 1941. BULL. MUS. NATION. HIST. NAT. (Paris) (2) 13:450-454.
- 1943. ARCH. ZOOL. EXP. GEN. 83:1-21.
- 1945. MEM. MUS. NATION. HIST. NAT. (Paris) n.s. 21:117-152.
- REBAUT, H. 1931. BULL. SOC. HIST. NAT. TOULOUSE 62:443-465.
- SAVOS, M. G. 1958. Ph.D. Thesis, Oregon State College Corvallis, Oregon.
- SCHELLER, U. 1954. KUNGL. FYSIOGR. SÄLLSK. HANDL. n.f. 64:1-9.

- VAN ZWALUWENBURG, R. H. 1926a. HAW. PLANTERS' REC. 30:250-255.  
——— 1926b. REPT. ASSOC. HAW. SUGAR TECHNOLOGISTS MEETING 5:18-25.  
——— 1931a. PROC. HAW. ENT. SOC. 7:394.  
——— 1931b. *In* Williams, HANDBOOK OF INSECTS AND OTHER INVERTEBRATES OF HAWAIIAN SUGAR CANE FIELDS. HSPA Exp. Sta., Honolulu, 339-352.  
WILLIAMS, F. X. 1931. HANDBOOK OF INSECTS AND OTHER INVERTEBRATES OF HAWAIIAN SUGAR CANE FIELDS. HSPA Expt. Sta., Honolulu. 400 pp.  
WYMORE, F. H. 1931. BULL. CALIF. AGR. EXP. STA. 518:1-22.  
ZIMMERMAN, E. C. 1948. INSECTS OF HAWAII, Vol. 1, Univ. Haw. Press, Honolulu. 206 pp.